



## Tea consumption and the risk of oral cancer incidence: A case-control study from China



Jin-Ye Fu<sup>a</sup>, Jing Gao<sup>b</sup>, Zhi-Yuan Zhang<sup>a,\*</sup>, Jia-Wei Zheng<sup>a,1</sup>, Jian-Feng Luo<sup>c</sup>, Lai-Ping Zhong<sup>a</sup>, Yong-Bing Xiang<sup>b</sup>

<sup>a</sup> Department of Oral & Maxillofacial – Head & Neck Oncology, Ninth People's Hospital, School of Medicine, Jiao Tong University, Shanghai 200011, China

<sup>b</sup> Department of Epidemiology, Shanghai Cancer Institute, Shanghai 200032, China

<sup>c</sup> Department of Biostatistics, School of Public Health, Fudan University, Shanghai 200032, China

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### SUMMARY

**Objectives:** To evaluate the relation of tea consumption with the risk of oral cancer incidence.

**Subjects and methods:** A multicenter case-control study based on hospitalized population was conducted for evaluating the association of tea consumption with oral cancer risk in China. Black tea and green tea were separately analyzed. 723 cases and 857 controls were included. Unconditional multiple logistic regression model was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs) of oral cancer for tea consumption.

**Results:** The ORs for green tea consumption  $\geq 8$  g/day compared with  $<4$  g/day were 0.72 (95% CI 0.54, 0.93) for men, and 0.93 (95% CI 0.74, 1.26) for women. The ORs for black tea consumption  $\geq 6$  g/day compared with  $<2$  g/day were 0.97 (95% CI 0.74, 1.20) for men, and 0.91 (95% CI 0.68, 1.23) for women. Green tea intake was significantly associated with reduced risk of oral cancer in men, but not in women, and the association was stronger in heavily smoking men. There was no indication that black tea consumption was associated with decreased oral cancer risk.

**Conclusion:** The results of this study indicated that green tea consumption may decrease the risk of oral cancer in men especially for those smoking heavily.

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### Introduction

Oral cavity cancer, comprises cancer of tongue, buccal mucosa, upper or lower gingival, floor of mouth and hard palate, represents the eighth most frequent cancer worldwide.<sup>1</sup> In China, it was reported 3.29 per 100,000 as incidence rate and 1.49 per 100,000 as mortality rate in 2008.<sup>2</sup> Oral cancer is a serious and growing problem in many parts of the globe,<sup>3</sup> mainly due to its low survival rate<sup>4</sup> and decreased life quality,<sup>5,6</sup> especially for advanced cases. Thus, primary prevention is important.

Tea consumption has attracted much attention for its potential cancer preventive effect for many years. Evidence from laboratory studies strongly showed the inhibition of tumorigenesis by tea and its constituents.<sup>7,8</sup> The mechanisms included modulation of signal transduction and metabolic pathways, which resulted in enhance-

ment of apoptosis, suppression of cell proliferation and inhibition of angiogenesis in cell culture systems.<sup>9–12</sup> However, epidemiologic studies on the issue were limited and the results were inconsistent.

Chinese population has a long tradition of tea consumption. It is easy and convenient to drink tea, and a lot of people have a daily habit of tea intake. There is a variety of tea in the market. Black tea and green tea are the two major types of consumption. Thus, it is feasible to conduct a large investigation on tea intake habits and oral cancer risk.

In this study, we analyzed the relationship between tea consumption and the risk of oral cancer incidence, from data of a multicenter case–control study on risk factors of oral cancer in China.

### Subjects and methods

A hospital-based case-control study on risk factors of oral cancer incidence was conducted in 8 cities in different part of China from 2007 to 2010. Subjects participated in the study were classified as from eastern, middle, southern, western and northern part of China, according to their long term residency. Same

\* Corresponding author. Address: Department of Oral & Maxillofacial – Head & Neck Oncology, Ninth People's Hospital, School of Medicine, Jiao Tong University, No. 639 Zhi Zao Ju Road, Shanghai 200011, China. Tel.: +86 21 23271124; fax: +86 21 63136856.

E-mail addresses: [fjy0712@hotmail.com](mailto:fjy0712@hotmail.com) (J.-Y. Fu), [zhzhy639@163.com](mailto:zhzhy639@163.com) (Z.-Y. Zhang), [zhjw@omschina.org.cn](mailto:zhjw@omschina.org.cn) (J.-W. Zheng).

<sup>1</sup> Co-corresponding author. Tel.: +86 21 23271063; fax: +86 21 63121780.

questionnaire and inclusion criteria were used in all the collaboration hospitals.

Cases were patients aged from 30 to 80 years with incident and histologically confirmed oral squamous cell cancer. Second primary tumor was excluded. The lesion sites covered tongue, buccal, upper or lower gingival, floor of mouth, palate and tongue base.

Controls were patients identified from the same hospital and during the same period as cases. They were inpatients from oral and maxillofacial surgery department, head and neck surgery department, orthognathic surgery department or trauma ward. They were admitted for non-malignant conditions, unrelated to tobacco smoking and alcohol drinking. Controls were frequency-matched to cases by gender, 5-year age group and long term residency area. In order to make a good balance, the proportion of controls within a specific diagnostic group did not exceed 20% of the total.

In both cases and controls, it was less than 5% of interviewed individuals that refused to participate in the investigation.

Face to face interviews were conducted within 2 days of the subject's admission by trained interviewers using a structured questionnaire. It included information on socio-demographic characteristics, anthropometric variables, physical activity, medical history, family history of cancer, smoking and alcohol drinking habits and tea consumption habits. Information on alcohol drinking and tea consumption referred to during the 2 years before the awareness of the disease symptoms for cases or 2 years before the interview for controls.

Information on tea consumption was obtained by asking the subjects which kind of tea they preferred most and followed by which kind; how many times they usually drank tea in a day. In case of less than once a day, they were asked by week or month. The average amount of tea intake per time was also collected. Most people in the investigation drank tea by using dry tea leaves; some of the subjects used to teabag. Averagely, one sack of teabag is about 2 g. To estimate the amount of daily consumption of tea leaves, we asked the subjects to estimate the weight of dry leaves they consumed every time or by asking how long 150 g tea leaves were consumed (150 g is a common package in the market). Intakes occasionally were coded as less than 2 g per day, which was equivalent to one sack of teabag. The amount of tea intake was converted to grams per day in the analyses.

The study was approved by the medical ethics committee of medical school of Shanghai Jiao Tong University in October 2006, where the central secretariat of the study was located. All subjects participated in this study had been informed the purpose and the content of the investigation. The interviews began only after the consent form had been signed.

#### Data analysis

Most subjects in the study usually drank black tea or green tea. Other kinds of teas were consumed irregularly and by people less than 5%. Thus, they were not taken into final analyses.

Chi-square was used to examine the distribution of cases and controls by age, gender, region, years of education, cigarette smoking and alcohol drinking.

Odds ratios (ORs) and the corresponding 95% confidence intervals (CIs) were derived from unconditional multiple logistic regression models to estimate the incidence risk of oral cancer according to green tea and black tea consumption. Adjustment was made for age, gender, long term residence area, years of education, tobacco smoking and alcohol drinking. Two-sided *P* values were calculated. Statistical significance was defined as *P* < 0.05.

Statistical analyses were conducted by using the SPSS software version 19.0.

## Results

Table 1 shows the distribution of 723 cases and 857 controls according to age, region, education, cigarette smoking and alcohol drinking, separately for the two sexes. Smoking and alcohol drinking are known as the major risk factors for oral cancer. By design, the distributions of age, gender and region were similar in cases and controls. Males represented 67.1% cases, 72.0% of them were aged from 50 to 70 years. Male cases were less educated and reported higher cigarette and alcohol consumption than controls. Few females, both cases and controls, had habits of cigarette smoking or alcohol drinking. Most subjects in the study were from eastern, southern and middle part of China.

The ORs and corresponding 95% CIs of oral cancer according to consumption of green tea and black tea are presented in Table 2. In men, a significant decreased risk was observed for green tea intake. Compared to green tea drinkers of less than 4 g per day, those drinking 8 or more grams per day had an OR of 0.72 (95% CI 0.54, 0.93). No significant association was found for black tea consumption in men. With reference to women, both green tea and black tea intake lack a significant association with oral cancer incidence. The ORs were 0.93 (95% CI 0.74, 1.26) for green tea and 0.91 (95% CI 0.68, 1.23) for black tea, as the highest category compared to the lowest category of tea consumption.

We further estimated the ORs of oral cancer for green tea consumption  $\geq 8$  g per day in men in strata of age, education, cigarette smoking and alcohol drinking (Table 3). The inverse association of oral cancer according to green tea intake of 8 or more grams per day was apparently stronger in current heavy smokers, compared to light or non smokers.

## Discussion

In this study, green tea consumption was inversely related with the oral cancer risk in men. The inverse association was apparently stronger in current heavy smokers. Data on green tea consumption in women and black tea consumption indicated a lack of material association.

In the study, the association of oral cancer risk with tea consumption was separately analyzed in men and women. One reason for such division is the potential different aetiology of oral cavity cancer between sexes. In male subjects, current smokers and heavy smokers were significantly more in cases than in controls. It was similar to most previous studies and supported that smoking is one of the main risk factors for oral cancer in men.<sup>13,14</sup> While, female subjects had few smokers in both cases and controls. This indicated that some risk factors, other than smoking, might be taken into account for oral cancer incidence in women. Another reason is the somewhat difference in habits of tea consumption between sexes in Chinese population. Tea drinkers are more common in men than in women, especially in elder people.<sup>15</sup> Green tea drinkers are more than black tea drinkers; however, women tea drinkers preferred black tea to green tea.<sup>16,17</sup>

Tea consumption had attracted much attention for its relation with many health benefits, especially its potential cancer prevention characters. Although biological supports had been shown in animal models and cell culture systems, epidemiological studies were limited on relations between cancer prevention effects and tea drinking. Existing studies yielded inconsistent results on oral cavity cancer and tea consumption. A multicenter study carried out in several European countries<sup>18</sup> showed a significant reduced risk of tea consumption for cancers of the upper aerodigestive tract (UADT). An Italian study<sup>19</sup> reported an inverse relation between oral cancer risk and high intake of tea and coffee combined, and it was more marked in women. Chyou et al<sup>20</sup> prospectively studied

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